Volume : 3 | Issue : 10 | October 2014 • ISSN No 2277 - 8179

Research Paper

Effect of Different Processing Methods on Quality of Fresh and Stored Papaya Candy

Agriculture

KEYWORDS : Packaging, citric acid ,benzoic acid, Papaya and candy

*** Chauhan Neelesh**	Assistant Professor, Department of Agricultural Engineering and Food Technology; College of Agriculture; Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110, INDIA. * Corresponding Author
Samsher	Professor & Act. Dean (Agric.), Department of Agricultural Engineering and Food Technology; College of Agriculture; Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut- 250110, INDIA.
Singh Papu	Ph. D. Scholar, Department of Agricultural Engineering and Food Technology; College of Agriculture; Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110, INDIA.
Singh B.R.	Professor & Ex-HOD, Department of Agricultural Engineering and Food Technology; College of Agriculture; Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut- 250110, INDIA.
Singh Jaivir	Assistant Professor, Department of Agricultural Engineering and Food Technology; College of Agriculture; Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110, INDIA.

ABSTRACT

The study revealed that the moisture content increased with citric acid levels in case of all three processing methods. The values of moisture content increased with citric acid levels in case of all three processing methods. The values of moisture content were found to have decreased after 30, 60 and 90 days of storage. The data showed that the samples packed in PET jars underwent decline in moisture content than the samples packed in PP pouches. The TSS decreased with increase in the level citric acid in tall samples. The TSS was fund to be higher than PP pouches and glass jars respectively at the same level of citric acid. Acidity of fresh samples prepared by first and third processing method at all levels of citric acid. Data obtained for browning index after 30, 60 and 90 days of storage indicated that in case of all samples, the values increased for processing method. The samples having citric acid levels of 0.5%, 0.75% and 1.0% prepared with first processing method had moisture content values of 16.04% and 16.38%, 16.68 and 16.74%, 17.80% and 17.87% respectively after 90 days of storage in PET jars and PP pouches.

Introduction

Papaya fruits are harvested manually when the trees are short. But with older trees whose fruits are beyond the reach of the picker, the mechanical harvesting aids are used. The papaya fruits are rich source of vitamins, particularly ascorbic acid and β-carotene. Ripe fruits contain about 7-9 percent sugar and are valued as breakfast fruit usually with added sugar and lime juice. Preserves of various kinds and marmalades are made from papaya. The fruit is also used for making puree, fruit drinks and frozen chunks. Unripe fruits are consumed as a vegetable. Papaya is the commercial source of enzyme papain. This is distributed throughout the plant, but more concentrated in the latex of the fruit. The latex is obtained by making a longitudinal incision of the surface of the nearly matured fruit. The coagulated latex gives the protein hydrolyzing enzyme which is used in tenderizing meat. It is also used in the manufacture of chewing-gum and in the brewing industry to digest protein fragment of chilled beer so that it remain clear. Papaya is treated to reduce storage decay by immersing in hot water at 49^{0}C for 20 min then cooled in running water for 20 min (Akamine and Arisumi 1953). The shelf life of papaya can be extended further by controlled atmosphere storage of 1 to 1.5% oxygen. Papaya has been described as an excellent source of pro vitamin A and ascorbic acid (Wenkem and Miller; 1965). Because of its year-round availability, papaya are an important source of vitamin C in the diet of the rural population of tropical Latin America and Asia (De Arriola et al., 1980). Giri et al. (1980) evaluated nutritive contents of five varieties of papaya in different stages of ripening and they found that chief nutritive components of papaya are vitamins and minerals. These fruits are rich in Vitamin C, Carotene and Vitamin A, which are more important in the human diet. The subepidermal latex disappear and the weight of the fruit decreases. A climacteric rise in CO_2 production with the ripening of the fruits was reported by Jones and Kubota (1940). Maturing papaya also emits ethylene and application of ethylene initiates respiratory rise and ripening in detached fruits (Akamine and Goo, 1979). Dollar et al. (1969) reported that sucrose was not present at any time during post harvest ripening. The discrepancy in the reported values was shown by Chan and Kwok (1975) to be caused by an invertase enzyme in papaya. By inactivating the enzymes with microwave heating before extracting the sugars, we determined the sugar composition of ripe papayas to be 48.3% sucrose, 29.8% glucose and 21.9% fructose. Trace quantities of sedoheptulose in papaya were reported by Ogata et al (1972).

Materials and Methods

Studies were also carried out to evaluate the quality of papaya candy in terms of physico-chemical and sensory characteristics just after preparation and after 30, 60 and 90 days of storage in glass Jars, PET jars and PP pouches at ambient temperature conditions.

Preservative and Acid

Benzoic acid @ 600 ppm (Qualiqens Fine chemical, Mumbai) was used as preservative in papaya candy. Citric acid was used within the permissible limit to increase the acidity and clarify the sugar syrup.

Packaging Materials

Finished papaya candies were packed in glass Jars, PET Jars and PP pouches for storage studies. The sugar syrup deep in glass jar as shown in plate 1.

Volume : 3 | Issue : 10 | October 2014 • ISSN No 2277 - 8179

Table 1. Experimental layout for papaya candy

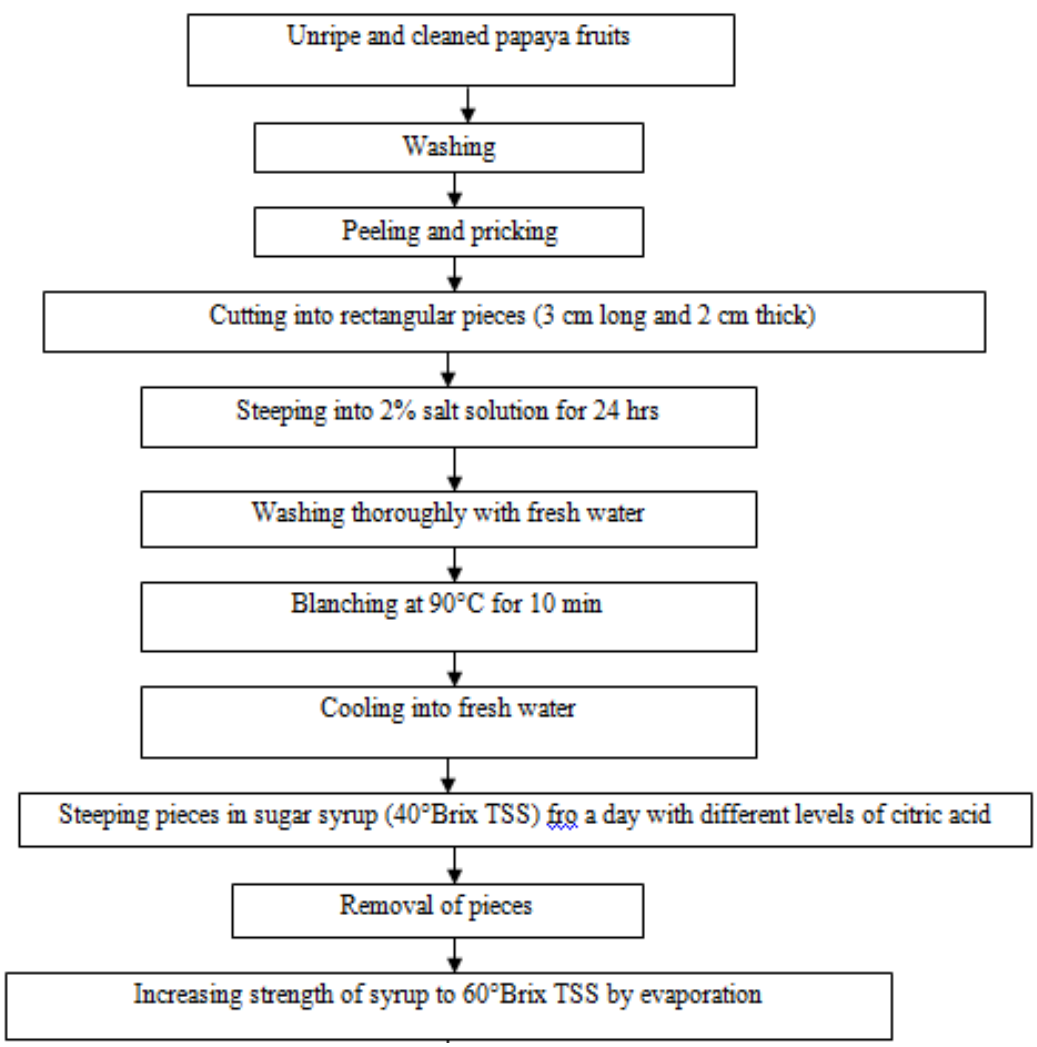
Variables/ Parameters	Levels	Descriptions	Measuring Parameters
Sample size	1	750 gm	
TSS (initial)	1	40 °Brix	(a) Physico-chemical quality- Moisture content, TSS, Acidity, optical density, Vitamin-C,
TSS (final)	1	75 °Brix	
Citric acid	3	0.5%, 0.75%, 1.0% (w/w)	
Yellow Colour	1	4 ml	
Preservative (benzoic acid)	1	600 ppm	(b) Sensory quality attributes-(Colour, Taste, Flavour and Texture and Overall acceptability)
Packaging materials	3	Glass Jar, PET Jar and PP pouches	
Replications	3	-	



Plate 1. Papaya pieces dipped into sugar syrup with different levels of citric acid

Preparation of Papaya Candy

Papaya candy was prepared by adopting the Procedure as reported by Srivastava and Kumar (1994). The unripe papaya fruits were washed with fresh water, peeled, pricked, deseeded and cut into rectangular pieces of 3 cm long and 1.5-2.0 cm thick, followed by steeping into 2% commercial salt (sodium chloride) for 24 hours and thoroughly washed with fresh water. Papaya pieces were blanched by dipping into hot water (80°C) for 15 minutes. The blanched papaya pieces were dipped into syrup (40° Brix TSS) prepared with different levels of citric acid (0.50%, 0.75% and 1.0%) for 24 hours. The strength of syrup was increased by 5 °Brix TSS at alternate day to the final strength of 75 °Brix TSS at which steeping was done continuously for 3 days. After draining syrup, candy pieces were quickly washed with hot water to remove syrup adhering to the surface followed by drying in tray dryer at 60°C for 6 to 6.5 hours. Dried samples were then packed in glass jars, PET jars and polypropylene pouches for further studies. The process flow chart is given in Fig. 1.



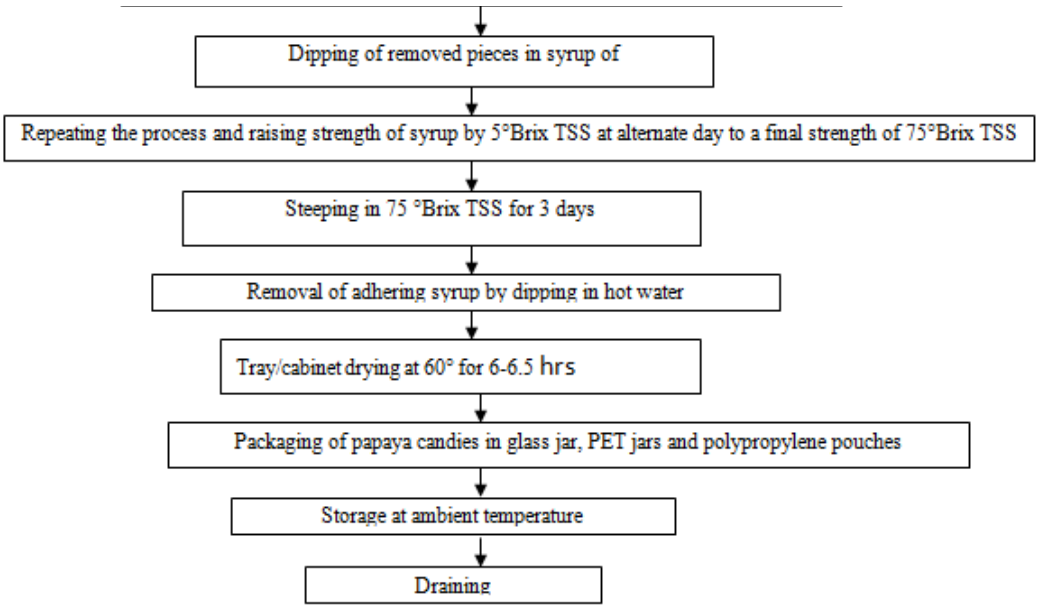


Fig. 1 Process flow chart for preparation of papaya candy

The experimental data for changes in moisture content is shown in Table 1. The bar charts for the effect of processing method, citric acid levels and packaging materials on moisture content is shown in Fig. 2. Samples prepared with processing method using citric acid level of 0.5%, showed the marginal difference in values of final moisture content of fresh samples. The values of moisture content were obtained as 17.25, 17.40 and 17.12 percent, respectively. The study revealed that the final moisture content of fresh papaya candy samples prepared with 0.75% and 1.0% citric acid were found in increasing order for processing method. It was also observed that the final moisture content was affected by citric acid level in the candy. The study revealed that the moisture content increased with increase in citric acid level in case of processing method.

Table 2 Change in TSS of papaya candy during storage as affected by processing methods, citric acid levels and packaging materials

Processing Methods	Storage Period	Total Soluble Solids								
		$M_1PC_{0.5}$			$M_1PC_{0.75}$			$M_1PC_{1.0}$		
		GJ	PJ	PP	GJ	PJ	PP	GJ	PJ	PP
I	Fresh	79.20 ± .042	79.20 ± .131	79.20 ± .420	78.20 ± .011	78.20 ± .036	78.20 ± .088	77.80 ± .011	77.80 ± .040	77.80 ± .038
	30 days	79.30 ± .092	79.50 ± .011	79.50 ± .024	77.60 ± .020	78.40 ± .026	78.20 ± .021	77.30 ± .038	77.80 ± .011	77.80 ± .031
	60 days	79.30 ± .032	79.80 ± .201	79.70 ± .061	77.40 ± .212	78.60 ± .044	78.30 ± .033	76.90 ± .037	77.90 ± .024	77.90 ± .044
	90 days	79.40 ± .011	80.20 ± .221	80.00 ± .076	77.20 ± .034	78.80 ± .082	78.60 ± .038	76.60 ± .008	78.00 ± .036	77.90 ± .026
II		$M_2PC_{0.5}$			$M_2PC_{0.75}$			$M_2PC_{1.0}$		
		GJ	PJ	PP	GJ	PJ	PP	GJ	PJ	PP
	Fresh	79.00 ± .026	79.00 ± .028	79.00 ± .033	78.00 ± .146	78.00 ± .092	78.00 ± .034	77.60 ± .112	77.60 ± .034	77.60 ± .023
	30 days	79.10 ± .034	79.50 ± .012	79.40 ± .012	77.70 ± .122	78.20 ± .023	78.20 ± .012	77.00 ± .023	77.70 ± .026	77.70 ± .012
	60 days	79.20 ± .062	79.80 ± .020	79.70 ± .081	77.30 ± .088	78.50 ± .012	78.30 ± .026	76.50 ± .033	77.80 ± .011	77.80 ± .024
	90 days	79.30 ± .012	80.00 ± .121	79.90 ± .033	77.00 ± .008	78.60 ± .111	78.40 ± .054	76.10 ± .112	77.90 ± .078	77.80 ± .084
III		$M_3PC_{0.5}$			$M_3PC_{0.75}$			$M_3PC_{1.0}$		
		GJ	PJ	PP	GJ	PJ	PP	GJ	PJ	PP
	Fresh	80.00 ± .011	80.00 ± .162	80.00 ± .021	79.00 ± .021	79.00 ± .210	79.00 ± .121	78.50 ± .041	78.50 ± .012	78.50 ± .086
	30 days	80.30 ± .083	80.50 ± .181	80.40 ± .034	78.70 ± .084	79.40 ± .026	79.30 ± .311	78.00 ± .048	78.70 ± .026	78.60 ± .092
	60 days	80.40 ± .012	80.90 ± .172	80.80 ± .036	78.30 ± .002	79.70 ± .094	79.60 ± .026	77.50 ± .006	78.80 ± .112	78.70 ± .120
	90 days	80.50 ± .111	81.40 ± .094	81.20 ± .039	78.00 ± .011	80.00 ± .081	79.90 ± .041	77.00 ± .012	78.90 ± .084	78.80 ± .121

M_1P = Processing method-I **$C_{0.5}$ = 0.5% Citric acid level**
M_2P = Processing method-II **$C_{0.75}$ = 0.75% Citric acid level**
M_3P = Processing method-III **$C_{1.0}$ = 1.0%Citric acid level**
GJ = Glass Jar

Volume : 3 | Issue : 10 | October 2014 • ISSN No 2277 - 8179

PJ = PET Jar
PP = Poly propylene

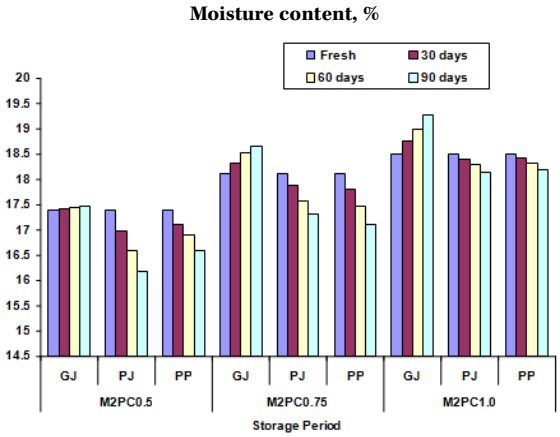


Fig. 2 Effect of second processing method, citric acid levels and packaging

Effect of quality and storage

Study revealed that the fresh samples of third processing method exhibited better sensory scores for colour, flavour and overall quality attributes. Sensory scores decreased rapidly in case of samples prepared by third method than those of first and second processing method at the citric acid level of 0.5%, 0.75% and 1% during storage. The reason may be attributed to increase in the values of TSS, browning index and acidity of papaya candy samples which exhibited darkened colour, hard texture and developed off flavour. Samples prepared by first processing method gave the highest overall sensory scores as 7.4725, 7.445 and 7.4325 for samples packed in PET jar, PP pouches and glass jar respectively after 90 days of storage period at the level of 0.75% citric acid. Study indicated that the samples prepared by all three processing methods exhibited highest sensory score at 0.75% citric acid level than those of 0.5 and 1% citric acid levels respectively after 90 days of storage.

Conclusion

The unripe papaya fruits were washed with fresh water, peeled, pricked, deseeded and cut into rectangular pieces of 3 cm long and 1.5-2.0 cm thick, followed by steeping into 2% commercial salt (sodium chloride) and 1% calcium chloride for 2 hours and thoroughly washed with fresh water. Papaya pieces were blanched by dipping into hot water (90°C) for 10 minutes. The blanched papaya pieces were dipped in sugar syrup having TSS of 50°Brix for 24 hours prepared by different levels of citric acid. The strength of syrup was increased by 5°Brix TSS at alternate day to a final strength of 75°Brix TSS at which steeping was done continuously for 3 days. After draining syrup, the candy pieces were quickly washed with hot water to remove syrup adhering to the surface followed by drying in tray dryer at 60°C for 6 to 6.5 hours. In case of other two methods of candy preparation, only blanching, temperature and drying procedure was differed. Dried samples were then packed in glass jars, PET jars and polypropylene pouches for further studies.

- The TSS was found to be higher for fresh samples prepared by first processing method than those of second processing method at particular level of citric acid. Study also revealed that TSS of samples packed in PET jars were found to be higher than PP pouches and glass jars respectively at the same level of citric acid.
- The data obtained for acidity of fresh samples of papaya candy indicated that with increase in citric acid levels, the acidity increased in all three processing methods. The acidity of fresh samples prepared by first processing method were found to be 0.752, 1.024 and 1.344% at citric acid levels of 0.5%, 0.75% and 1.0% respectively.
- Acidity of fresh samples prepared by third method were observed little higher than those of first processing method. This was probably due to the change in drying method. Acidity of fresh samples prepared by second processing method were found to be higher than those of samples prepared by first and third processing method at all levels of citric acid.
- Results revealed that acidity of samples invariably increased after 30, 60 and 90 days of storage in case of all three processing methods. However, this increase was more pronounced in case of samples packed in glass jars as compared to their counterparts packed in PET jars and PP pouches. Papaya candy samples prepared by third processing method were observed high increasing ratio in acidity after 30, 60 and 90 days of storage as compared to their counterparts prepared by first and second processing method packed in different packaging materials at all citric acid levels.
- Samples prepared by first processing method exhibited the highest overall sensory scores of 7.4725, 7.445 and 7.4325 for samples packed in PET jar, PP pouches and glass jar respectively after 90 days of storage at the level of 0.75% citric acid. Study also indicated that the samples prepared by all three processing methods exhibited maximum sensory scores at 0.75% citric acid level than those of 0.5 and 1% citric acid levels, respectively after 90 days of storage.

REFERENCE

Akamine, E.K. and Goo, T. (1979). Concentrations of carbon dioxide and ethylene in the cavity of attached papaya fruit. Hort. Sci. 14 (2) : 138-139. | Akamine, E.K., and Arisumi, T. (1953). Control of post-harvest storage decay of fruits of papaya (Carica papaya L.) with special reference to the effect of hot water. Proc, Am. Soc. Hort. Sci. 61: 270-274. | Chan, H.T. Jr., and Kwok, S.C.M (1975). Importance of enzyme inactivation prior to extraction of sugars from papaya. J. Food Sci. 40 : 770 – 771. | De Arriola, M.C., Calzada, J.F., Menchu, J.E., Rolz, C., Gracia, R., and de Cabrera, S. (1980). Papaya. In Tropical and subtropical fruits: Composition, Nutritive values, Properties, and Uses (S. Nagy and P.E. Shaw, eds.). Westport, Conn., Avi Pub. C0., PP – 316-340 | Dollar, A.M., Hanaoka, M., Moy, J.H., Cinnamon, A.D., Hamill, E., Helber, D., Hsia, S.T., and Wenkam, D. (1969). Physiological, chemical, and physical changes during ripening of papaya. In Radioisotope and Radiation Applications, NVO-347-17, TID-4500. Division of Isotopes Development, U.S. Atomic Energy Commission, p-86. | Giri J. Bhuvaneswari V and Tamilasrasu R (1980). Studies on the evaluation of nutritive contents of five variety of papaya in different stage of ripening the Ind. J. Nutr. Dietet 319-324. | Jones, W.S. and Kubota, H. (1940). Some respirational changes in the papaya fruit during ripening and the effects of cold storage in these changes. Plant Physiol. 15 :711. | Ogata, J.N., Kawano, Y., Bevenue, A., and Casarett, E.J. (1972). The ketopheptose content of some tropical fruits. J. Agric. Food Chem. 20: 113-115 | Srivastave R.P. and Kumar S. (1994). Fruits and vegetables preservation (Principles and facts). International Book Distributing Company, Charbagh, Lucknow. | Wenkam, N.S., and Miller, C.D. (1965). Composition of hawaii fruits. Bulletin 135. Honolulu, Hawaii, Hawaii Agric. |